# *TRITIUM STACK EMISSION CALCULATION AND REPORTING*

**Purpose**   This Air Quality Group procedure describes the process used to calculate and report tritium stack emissions monitored by an EG&G Labserco EL-700 bubbler.  The method described in this procedure meets the requirements of 40 CFR 61, Subpart H (Rad-NESHAP).

**Scope**   This procedure applies to individuals in the Air Quality Group assigned to check, evaluate, report, and upload tritium emissions data from stacks monitored by an EG&G Labserco EL-700 bubbler.

**In this procedure**   This procedure addresses the following major topics:

| Topic | See Page |
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**Hazard Control Plan**   The hazard evaluation associated with this work is documented in HCP-ESH-17-Office Work.

**Signatures**

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|---|---|
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| Work authorized by:<br><br>_____<br>Doug Stavert, ESH-17 Group Leader | Date:<br><br>9/29/01 |

10/26/01

# General information about this procedure

**Attachments**    This procedure has the following attachments:

| Number | Attachment Title | No. of pages |
|---|---|---|
| 1 | Calculations Used in Tritium Emissions | 2 |
| 2 | Calculation Sheet for Tritium Bubbler Calibrations | 1 |

**History of revision**    This table lists the revision history and effective dates of this procedure.

| Revision | Date | Description of Changes |
|---|---|---|
| 0 | 4/10/95 | New document. |
| 1 | 10/11/96 | Includes new group structure and process changes. |
| 2 | 9/27/99 | Revised to describe use of spreadsheet used for calculations, equations moved to attachment, and checklist and calculation sheets added. |
| 3 | 11/4/99 | Revised Attachment 1. |
| 4 | 8/23/00 | Revised to describe use of database system to replace spreadsheet for data entry and checking. |
| 5 | 10/15/01 | Add lines to Attachment "Calculation Sheet" to clarify which value to enter into database, remove Attachment "Checklist For Tritium Stack Data Evaluation." |

**Who requires training to this procedure?**    The following personnel require training before implementing this procedure:

- ESH-17 personnel performing all or part of this procedure

**Training method**    The training method for this procedure is **on the job** training and is documented in accordance with the procedure for training (ESH-17-024).

**Prerequisites**    In addition to training to this procedure, the following training is also required before performing this procedure:
- ESH-17-118, "Categorizing and Reporting Increased Airborne Radioactive Emissions from Sampled Stacks"

# **General information about this procedure**, continued

**References**   The following documents are referenced in this procedure:
- ESH-17-024, "Personnel Training"
- ESH-17-026, "Deficiency Reporting and Correcting"
- ESH-17-106, "Collecting Tritium Stack Bubbler Samples"
- ESH-17-118, "Categorizing and Reporting Increased Airborne Radioactive Emissions from Sampled Stacks"
- ESH-17-139, "Analytical Chemistry Data Management and Review for Rad-NESHAP Program"
- ESH-4-RIC-DP-42, "Calibration Procedure of Tritium Bubblers Monitoring Stack Emissions"
- ESH-4-HPAL-DP-15, "Procedure for Liquid Scintillation Analysis"
- 40 CFR Part 61, subpart H, NESHAP
- HCP-ESH-17-Office Work, "Hazard Control Plan for Office Work"

**Note**   Actions specified within this procedure, unless preceded with "should" or "may," are to be considered mandatory guidance (i.e., "shall").

# Verifying tritium data package

**Background**

Tritium emission sampling is performed using an EL-700 bubbler. This instrument collects tritium in vials containing ethylene glycol. These ethylene glycol samples are collected according to ESH-17-106 and sent to ESH-4 Health Physic Analytical Laboratory (HPAL) for liquid scintillation counting.

HPAL transmits a liquid scintillation counting results EDD file to ESH-17 via e-mail for each set of ethylene glycol stack samples.

**Check the analytical data**

Follow ESH-17-139 to verify and validate the analytical data and the data package.

**Document and resolve any problems**

If any of the criteria are not met, take appropriate action to resolve the discrepancies. Request re-aliquot and re-count if discrepancies cannot be resolved by checking analysis results.

If the verification identifies a problem requiring corrective action, initiate a deficiency report in accordance with procedure ESH-17-026.

# Calculating tritium emissions

**Calculation of tritium emissions**

The calculation of the emissions is performed by electronically uploading the HPAL data into an Access database.

In the event the tritium activities need to be calculated manually, or if the operation of the upload needs to be verified, perform the manual calculations given in Attachment 1.

**Upload tritium data**

Upload the data and calculate tritium stack emissions electronically by performing the following steps.

| Step | Action |
| :---: | :--- |
| 1 | Open the Access database RADAIR. Click on "Forms" then click on "Main Switchboard." Under the column "Chem Data," click "Tritium Bubbler." |
| 2 | Transfer of EDD file (Analytical data from HPAL) from e-mail to "Access table". In Access open file "Get external data" → Import →Click Eudora→Click Attachments→Click file name (h3xx-xxmonth) by sample run date→EDD file now loaded into access. |
| 3 | On the screen "RADAIR Tritium Chemistry Data Mgt": <br> • Click Select R# (*RYYMMDD)* and select the file name for this period. <br> • Under the column "EDD Upload & Archive", click on button "Inspect DE table" and then, in sequence, each button in the column. <br> • Under the column "Reports," click each button in sequence. |
| 4 | From the query results "Inspect MS in Archive", visually inspect the % recovery is $100 \pm 10\%$. If not within this range, check the raw data for proper upload, hand calculate the value to check the program, or notify HPAL to reanalyze the samples. |
| 5 | From the report "Tritium Expected Emissions Evaluation", if all is OK, sign and date the report. If there is any exceedance, follow procedure ESH-17-118 before proceeding with the next steps. |
| 6 | Add any new comments about a specific sample, if any data corrections or changes were made. |
| 7 | If there was a calibration of a bubbler during the sample period, perform the steps in the next chapter *Adding additional tritium from bubbler calibrations*. |
| 8 | Continue with the steps in the chapter *Reporting measured emissions to facilities*. |

# Adding additional tritium from bubbler calibrations

**Background**    ESH-4 performs calibrations of the stack bubblers every six months.  To do the calibrations, they remove the bubbler vials, install their own, and release a known amount of tritium up the stacks.  This released amount must be added to the amount measured by the bubbler samples during the sample period.

**Calculation of tritium released**    ESH-4 HPAL provides a memo to ESH-17 that documents the amount of tritium released during the calibrations.  Using these data, hand-calculate the amount of tritium released (use Attachment 2, "Calculation Sheet for Tritium Bubbler Calibration").  Obtain an independent review of the calculations and sign the bottom of the form.

In the same database described in the previous chapter, go to the screen "Tritium Field Data Operations."  Click on "Cal Gas Stacked Entry."  Enter the amount of tritium 'stacked' for the calibration and, in the comments, enter the Curies of HT stacked during calibration.

# Reporting measured emissions to facilities

**Reporting emissions**

Upload the tritium data to the web page *http://hotair.lanl.gov/AirQuality/* for reference by facility personnel.  Send e-mail to the receiving groups with "Return receipt" requested.

**Facility response to the tritium emission report**

Facility personnel generally have five (5) business days after the return receipt is received by ESH-17 to challenge the reported tritium emission data or to report discrepancies to ESH-17.

**Investigation of emission report challenges**

If the facility challenges the reported emission data or reports discrepancies, perform the following steps to investigate, resolve, and document the issues.

| Step | Action |
|------|--------|
| 1 | Verify the validity of calculation input data received from ESH-17, and ESH-4.  Verify bubbler calibration information, response factor, and stack flow information.  Recheck emission calculations.  If the discrepancy is valid and was due to ESH-17 data errors, initiate a DR according to ESH-17-026. |
| 2 | Report the investigation results to the appropriate building manager or facility contact. |
| 3 | On the screen "RADAIR Tritium Chemistry Data Mgt": Under the column "Reports": <br>• Click on the button "New Comments?" and document the investigation and results. |

**Filing and uploading measured tritium emission data**

After five (5) business days and/or the resolution of reported discrepancies, place revised data on the LANL Air Quality Group (ESH-17) web page (*http://hotair.lanl.gov/AirQuality/*).

# Records resulting from this procedure

**Records**     The following records generated as a result of this procedure are to be submitted as records **within one week of completion** to the records coordinator:

- Calculation Sheet for Tritium Bubbler Calibration (Attachment 2), when stack calibrations performed

# *CALCULATIONS USED IN TRITIUM EMISSIONS*

**Calculation of tritium emissions**

These calculations are normally performed by an Access Database that is protected and revised, as necessary, in compliance with ESH-17 software QA requirements for verification and validation.

In the event the tritium activities need to be calculated manually, perform the following steps:

| Step | Action |
| :---: | --- |
| 1 | Verify you have the following activity data.<br><br>$A_1, A_2, A_3 =$ the activities measured in each sample vial of the first set of three bubbler vials<br>(reported in µCi/l by ESH-4)<br><br>$A_4, A_5, A_6 =$ the activities measured in each sample vial of the second set of three bubbler vials<br>(reported in µCi/l by ESH-4)<br><br>$A_{blank} =$ the activity measured in the blank vial<br>(reported in µCi/l by ESH-4) |
| 2 | Verify you have the following weights.<br><br>$W_1, W_2, W_3 =$ the weight of ethylene glycol in each vial of the first set of three bubbler vials<br>(reported in grams by ESH-1 or ESH-17)<br><br>$W_4, W_5, W_6 =$ The weight of ethylene glycol in each vial of the second set of three bubbler vials<br>(reported in grams by ESH-1 or ESH-17) |
| 3 | Obtain the bubbler response factor ($R_{bubbler}$) reported by ESH-4.<br><br>Note: If $R_{bubbler} > 1$, use $R_{bubbler} = 1$ |

# *CALCULATIONS USED IN TRITIUM EMISSIONS,*
## *CONTINUED*

| Step | Action |
|------|--------|
| 4 | Calculate the ratio of stack flow to bubbler flow.<br><br>$$F_{ratio} = F_{stack} / (F_{bubbler}*CF)$$<br>Where:<br>  $F_{ratio}$ = the ratio of the flows<br><br>  $F_{stack}$ = the current reportable stack volumetric flow rate (reported in actual cfm by ESH-17)<br><br>  $F_{bubbler}$ = the bubbler volumetric flow rate (150 cc/min)<br><br>  $CF$ = 3.53E-05 ft$^3$/cc  Conversion factor to convert actual cc/min to actual cfm |
| 5 | Calculate the volume of ethylene glycol in each bubbler vial :<br>($V_1$, $V_2$, $V_3$, $V_4$, $V_5$, $V_6$)<br>$$V_i = W_i / \rho$$<br>Where:<br>  $V_i$ = Volume of the $i$th vial in ml ($i$ = 1 to 6)<br><br>  $W_i$ = Weight of the $i$th vial in grams<br><br>  $\rho$ = Density of ethylene glycol = 1.113 g/ml |
| 6 | Calculate the HTO activity (Ci) collected:<br>$$A_{HTO} = \frac{(A_1-A_{blank})V_1+(A_2-A_{blank})V_2+(A_3-A_{blank})V_3}{(1000 \ ml/L)(10^6 \ \mu Ci/Ci)}$$ |
| 7 | Calculate the HT activity (Ci) collected:<br>$$A_{HT} = \frac{(A_4-A_{blank})V_4+(A_5-A_{blank})V_5+(A_6-A_{blank})V_6}{(1000 \ ml/L)(10^6 \ \mu Ci/Ci)}$$ |
| 8 | Calculate the HTO activity (Ci) emitted:<br>$$HTO_{EMITTED}=E_{HTO}=F_{ratio}*A_{HTO}$$ |
| 9 | Calculate the HT activity (Ci) emitted:<br>$$HT_{EMITTED}=E_{HT}=(F_{ratio}*A_{HT})/R_{bubbler}$$ |

Air Quality Group
# CALCULATION SHEET FOR TRITIUM BUBBLER CALIBRATIONS
This form is from ESH-17-112

Stack ID: _____      Bubbler Calibration by ESH-4 on date: _____

Bubbler Response: _____

## HTO

Total dpm/ml collected = _____ = dpm/ml    ( _____ dpm/ml) (30ml) =

$\mu$Ci collected = $\dfrac{\text{Total activity [dpm]}}{2.22E6 \text{ [dpm/}\mu\text{Ci]}}$ =

$\mu$Ci emitted = $\mu$Ci collected x $F_{stack}$ / $F_{sample}$ =

Correct for downtime = $\mu$Ci emitted x $\dfrac{\text{Total cal time}}{\text{Total release time}}$ =

HTO entry to database = _____ $\mu$Ci

## HT

Total dpm/ml collected = _____ Total activity collected = ( _____ dpm/ml) (30ml) =

$\mu$Ci collected = $\dfrac{\text{total activity [dpm]}}{2.22E6 \text{ [dpm/}\mu\text{Ci]}}$ =

$\mu$Ci emitted = $\mu$Ci collected x $F_{stack}$ / $F_{sample}$ =

Correct for downtime = $\mu$Ci emitted x $\dfrac{\text{Total cal time}}{\text{total release time}}$ =

**HT** stacked = _____ mCi/ 1000 = _____ Ci*

**HT** stacked + collected = _____ Ci

HT entry to database (stacked + collected) = _____ $\mu$Ci

*NOTE: Add comment to database for stack field data: "_____Ci HT stacked during calibration"

Calculated by:

_____    _____    _____
Signature                                              Name (print)                                      Date

Verified by:

_____    _____    _____
Signature                                              Name (print)                                      Date

Air Quality Group
# CALCULATION SHEET FOR TRITIUM BUBBLER CALIBRATIONS
This form is from ESH-17-112

Stack ID: _____          Bubbler Calibration by ESH-4 on date: _____

Bubbler Response: _____

## HTO

Total dpm/ml collected =                          = dpm/ml     (                    dpm/ml) (30ml) =

$\mu$Ci collected = $\dfrac{\text{Total activity [dpm]}}{2.22E6\ [\text{dpm}/\mu\text{Ci}]}$  =

$\mu$Ci emitted = $\mu$Ci collected x $F_{stack}$ / $F_{sample}$ =

Correct for downtime = $\mu$Ci emitted x $\dfrac{\text{Total cal time}}{\text{Total release time}}$  =

HTO entry to database =                μCi

## HT

Total dpm/ml collected =                     Total activity collected = ( _____ dpm/ml) (30ml) =

$\mu$Ci collected = $\dfrac{\text{total activity [dpm]}}{2.22E6\ [\text{dpm}/\mu\text{Ci}]}$  =

$\mu$Ci emitted = $\mu$Ci collected x $F_{stack}$ / $F_{sample}$ =

Correct for downtime = $\mu$Ci emitted x $\dfrac{\text{Total cal time}}{\text{total release time}}$  =

**HT** stacked =                      mCi/ 1000 =                    Ci*

**HT** stacked + collected =                                        Ci

HT entry to database (stacked + collected) =                μCi

*NOTE: Add comment to database for stack field data: "_____Ci HT stacked during calibration"

Calculated by:

_____          _____          _____
Signature                                          Name (print)                                      Date

Verified by:

_____          _____          _____
Signature                                          Name (print)                                      Date